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Exercise - I (Conceptual Questions) Build Up Your Understanding

INTRODUCTION TO HOW MANY PIGMENTS ARE INVOLVED IN PHOTOSYNTHESIS

1. Oxygen which is liberated during photosynthesis comes from -
(1) Carbon dioxide
(2) Water
(3) Chlorophyll
(4) Phosphoglyceric acid

2. In which of the following process, the light energy is converted into chemical energy?
(1) Digestive action (2) Respiration
(3) Photosynthesis (4) Fermentation

3. During photosynthesis the oxygen in glucose comes from :-
(1) Water
(2) Carbon di oxide
(3) O_2 in air
(4) Both from water and CO_2

4. Name the scientist, who first pointed out by bell jar experiment that plants purify foul air:
(1) Willstatter (2) Robert Hooke
(3) Priestley (4) Jean Senebier

5. Moll's half leaf experiment explains that :-
(1) Carbon dioxide is essential for photosynthesis
(2) Chlorophyll and water are necessary for photosynthesis
(3) Light and water are essential for photosynthesis
(4) All the above are correct

6. Oxygen during photosynthesis comes from water was proved with the help of O^{18} experiment by:-
(1) Ruben and Kamen (2) Hill
(3) Warburg (4) Blackman

7. Name the scientist who pointed out the importance of different wavelengths of light using a green algae and aerobic bacteria :–
(1) Priestley (2) Ingen-Housz
(3) K.V. Thimann (4) Englemann

8. Photosynthesis is :-
(1) Oxidative, exergonic, catabolic
(2) Redox-reaction, endergonic, anabolic
(3) Reductive, exergonic, anabolic
(4) Reductive, endergonic, catabolic

9. The significance of light and chlorophyll in photosynthesis was discovered by :-
(1) Priestley (2) Ingenhousz
(3) Englemann (4) Blackman

10. Which one of the following pigment does not occur in the chloroplast?
(1) Carotene (2) Xanthophyll
(3) Chlorophyll 'b' (4) Anthocyanin

11. Chlorophyll contains :
(1) Fe (2) Mg (3) K (4) Mn

12. Which pigment is water soluble?
(1) Chlorophyll (2) Carotene
(3) Anthocyanin (4) Xanthophyll

13. Chlorophyll is present :
(1) In the grana of chloroplasts
(2) On the surface of chloroplasts
(3) Dispersed through out the chloroplasts
(4) In the stroma of chloroplasts

14. Which colour of light gives maximum absorption peak by chlorophyll 'a' ?
(1) Blue light (2) Green light
(3) Violet light (4) Red light

15. The formula of chlorophyll 'a' is :
(1) $C_{35}H_{72}O_5N_4Mg$ (2) $C_{55}H_{70}O_3N_4$ Mg
(3) $C_{55}H_{72}O_5N_4Mg$ (4) $C_{51}H_{70}O_6N_4$ Mg

16. The number of pigment molecules in photosystem is:
(1) 250 - 400 (2) 300 - 900
(3) 500 - 600 (4) 50 -100

17. The main difference between chlorophyll 'a' and 'b' is:
(1) Chlorophyll 'a' is a linear chain compound and 'b' is branched chain
(2) Chlorophyll 'a' has no Mg^+ ion in center of molecule
(3) In chlorophyll 'a' there is $-CH_3$ group whereas in 'b' it is –CHO group
(4) All of the above

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18. Basic common structure of all chlorophyll comprises of :-
(1) Cytochrome system
(2) Flavoproteins
(3) Porphyrin system
(4) Plastocyanin

19. What is the by product of bacterial photosynthesis?
(1) O_2 (2) CO_2 (3) S (4) H_2S

20. Which of the following chlorophyll is lack of phytol-tail?
(1) Chl'a' (2) Chl.'b'
(3) Chl.'c' (4) Chl.'e'

21. Universal chlorophyll is :-
(1) Chl-'a' (2) Chl 'b'
(3) Chl - 'c' (4) Chl - 'e'

22. Which one of the following is precursor of protochlorophyll?
(1) Acetyl COA (2) Succinyl COA
(3) Oxlaoacetic acid (4) α-ketoglutarate

23. Photosynthesis is an oxidation reduction process, the materials that is oxidised is :-
(1) CO_2 (2) NADP
(3) H_2O (4) PGA

24. During photosynthesis :-
(1) Water is reduced & CO_2 is oxidized
(2) CO_2 is reduced & water is oxidized
(3) Both CO_2 & water get reduced
(4) Both CO_2 & water get oxidized

25. Which photosynthetic pigment converts nascent oxygen to molecular oxygen ?
(1) Chlorophyll-a (2) Carotenoids
(3) Phycobilins (4) Chlorophyll-b

26. Hill reaction occurs in :–
(1) High altitude plants only
(2) Total darkness
(3) Presence of ferricyanide
(4) Absence of water

27. Photosynthetically active radiation (PAR) represents the following range of wavelength :-
(1) 400–700 nm (2) 500–600 nm
(3) 450–950 nm (4) 340–450 nm

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28. Which one of the following categories of organisms do not evolve oxygen during photosynthesis ?
(1) Red algae
(2) Photosynthetic bacteria
(3) C_4–plants with Kranz anatomy
(4) Blue green algae

29. The site for dark reaction of photosynthesis is:
(1) Stroma (2) Grana
(3) Intergrana (4) Mitochondria

WHAT IS LIGHT REACTION AND THE ELECTRON TRANSPORT

30. Discovery of Emerson effect has shown the existence of :–
(1) Two distinct photosystems
(2) Light and dark reactions of photosynthesis
(3) Photophosphorylation
(4) Photorespiration

31. Wavelength of light responsible for Emerson's enhancement effect :–
(1) only 680 nm
(2) only 680 nm↓
(3) infra red wavelength
(4) Both 680 nm and 680 nm↓

32. The process of photo-phosphorylation take place in :-
(1) Chloroplast (2) Ribosomes
(3) Mitochondria (4) Cell-wall

33. In pigment system -I, reaction centre is :-
(1) P-600 (2) P-680
(3) P-700 (4) P-720

34. Which of the following is the site of photolysis of water ?
(1) Stroma of chloroplast
(2) Cristae of chloroplast
(3) Ribosome of chloroplast
(4) Lumen surface of thylakoid membrane

35. The first step in photosynthesis is :-
(1) Joining of three carbon atoms to from glucose
(2) Formation of ATP
(3) Ionization of water
(4) Excitement of an electron of chlorophyll by a photon of light.

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36. The product of light reaction is :-
(1) ATP & NADPH(H^+)
(2) NADPH(H^+) & glucose
(3) Only ATP
(4) O_2 & glucose

37. Which one of the following concerns with photophosphorylation ?
(1) ADP + AMP light energy ATP
(2) ADP + Inorganic PO_4 ATP
(3) ADP + Inorganic PO_4 $\longrightarrow$ ATP
(4) AMP + Inorganic PO_4 $\longrightarrow$ ATP

38. During photochemical reaction of photosynthesis–
(1) liberation of O_2 takes place
(2) Formation of ATP and $NADPH_2$ take place
(3) Liberation of O_2, formation of ATP, and $NADPH_2$ takes place
(4) Assimilation of CO_2 takes place

39. Which of the following is excited molecule during photosynthesis ?
(1) Chlorophyll (2) Oxygen
(3) Carbondioxide (4) Water

40. During splitting of H_2O, H^+ is ultimately captured by :-
(1) Chlorophyll (2) NADP
(3) O_2 (4) Cytochrome

41. At the time of splitting of H_2O, which initially captures the electron :-
(1) Chlorophyll (2) NADP
(3) OH^- (4) Cytochrome

42. In cyclic photophosphorylation which one of the following is formed ?
(1) NADP & ATP
(2) ATP
(3) NADH + H^+ and O_2
(4) NADPH + H^+, ATP and O_2

43. Photooxidation of water in photosynthesis is associated with :-
(1) Cytochrome b_6
(2) Pigment system–I
(3) Pigment system–II
(4) Plastocyanin

44. During ATP synthesis electron pass through:-
(1) Water (2) Cytochromes
(3) O_2 (4) CO_2

45. Which pigment system immediately donates e^- for the reduction of NADP ?
(1) PS II (2) PS I
(3) CO_2 (4) Plastoquinone

46. Which element are presents in OEC (Oxygen evolving complex) ?
(1) Mn^{++} (2) Cl^-
(3) Ca^{++} (4) All

WHERE ARE THE ATP AND NADPH USED

47. The path of CO_2 in the dark reactions of photosynthesis was sucessfully traced by the use of the :–
(1) O_2^{18} (2) $C^{14}O_2$
(3) P^{32} (4) X - rays

48. Which of the following protein is most abundant on the earth?
(1) Catalase (2) RuBisCO
(3) Amylase (4) Pepsin

49. The function of ATP in photosynthesis is the transfer of energy from the :-
(1) Dark reaction to the light reaction
(2) Light reaction to the dark reaction
(3) Chloroplasts to mitochondria
(4) Mitochondria to chloroplasts

50. In photosynthesis, hydrogen is transferred from the light reactions to dark reactions by:–
(1) NAD (2) DNA
(3) ATP (4) NADP

51. NADPH(H^+) is also called :-
(1) Real power
(2) Oxidising agent
(3) Power house of energy
(4) Reducing power

52. Fixation of 1 CO_2 requires :–
(1) 6NADPH(H^+) & 3ATP
(2) 2NADPH(H^+) & 3ATP
(3) 4NADPH(H^+) & 3ATP
(4) 5NADPH(H^+) & 3ATP

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53. Connecting link between light phase and dark phase of photosynthesis, is :-
(1) Only ATP
(2) Only NADPH(H^+)
(3) Only NADH + H^+
(4) ATP & NADPH(H^+)

54. In photosynthesis CO_2 combines with :-
(1) RUBP (2) ATP
(3) ADP (4) PGA

55. During the dark reactions of photosynthesis:–
(1) Water splits
(2) CO_2 is reduced to organic compounds
(3) Chlorophyll is activated
(4) Stable C_6-sugar is broken into three carbon sugars

56. The enzyme that fixes atmospheric CO_2 in C_4 plants is :–
(1) PEP carboxylase (2) Hexokinase
(3) RUBP oxygenase (4) Hydrogenase

57. During photosynthesis when PGA is changed into phosphoglyceraldehyde which of the following reaction occur ?
(1) Oxidation (2) Reduction
(3) Electrolysis (4) Hydrolysis

58. Carbon refixation in C_4 plants occurs in chloroplasts of :–
(1) Palisade tissue
(2) Spongy Mesophyll
(3) Bundle sheath cells
(4) Gaurd cells

59. Tropical plants like sugarcane show high efficiency of CO_2 fixation because of :–
(1) Calvin cycle
(2) Hatch - Slack cycle
(3) Cyclic photophosphorylation
(4) TCA Cycle

60. "Kranz" type of anatomy is found in :–
(1) C_4 plant (2) C_3 plant
(3) Succulent plants (4) All of the above

61. Which of the following is C-4 plants ?
(1) Maize (2) *Atriplex*
(3) Sugarcane (4) All of the above

62. Which pair is wrong ?
(1) C_3 plant – maize
(2) Calvin cycle – PGA
(3) Hatch and Slack cycle – Maize
(4) C_4-plant – Kranz Anatomy

63. C_4 plants are found among :-
(1) Only gramineae family
(2) Only monocots
(3) Only dicots
(4) Monocots as well as dicots

64. In case of C_4 pathway, the first step is :-
(1) CO_2 combines with RUBP
(2) CO_2 combines with PGA
(3) CO_2 combines with PEP
(4) CO_2 combines with PGAL

65. In dark reaction, first reaction is the :-
(1) Carboxylation
(2) Decarboxylation
(3) Dehydrogenation
(4) Deamination

66. Number of ATP molecules required for regeneration phase of RUBP during synthesis of 1 glucose molecule :-
(1) 6 (2) 12 (3) 18 (4) 30

67. Isotopes employed to study the process of photosynthesis reaction.
(1) S^{35} and P^{32} (2) C^{14} and O^{18}
(3) N^{14} and Co^{60} (4) N^{14} and O^{18}

68. Chloroplast is present in bundle sheath cells of :-
(1) C_3 – plants
(2) C_4 – plants
(3) CAM plants
(4) Photorespiring plants

69. CO_2 is accepted by RUBP in C_4 plants in :-
(1) Mesophyll cells
(2) Bundle sheath cells
(3) Stomatal gaurd cells
(4) Epidermal cells

70. Bundle sheath chloroplasts of C_4 plant are :
(1) Large & agranal (2) Large & granal
(3) Small & agranal (4) Small & granal

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71. In addition to the 12 molecules of NADPH(H^+), the energy required for the synthesis of one mole of hexose by C_3 and C_4 pathway is–
(1) 18 & 18 molecules of ATP respectively
(2) 30 & 30 molecules of ATP respectively
(3) 18 & 30 molecules of ATP respectively
(4) 30 & 18 molecules of ATP respectively

72. How many Calvin cycles would generate one molecule of glucose/hexose ?
(1) One cycle
(2) Three cycles
(3) Six cycles
(4) Twelve cycles

73. CAM - plants are :-
(1) Succulent xerophyte
(2) Hydrophytes
(3) Epiphytes
(4) Mesophytes

74. The first stable product of Calvin cycle and Hatch stack pathway are :-
(1) 4-C and 3-C compounds respectively
(2) 4-C and 6-C compounds respectively
(3) 3-C and 4-C compounds respectively
(4) 5-C and 4 - C compounds respectively

75. Which of the following was used during discovery of Calvin cycle ?
(1) *Spirogyra* (2) *Volvox*
(3) *Chlamydomonas* (4) *Chlorella*

PHOTORESPIRATION & FACTOR AFFECTING PHOTOSYNTHESIS

76. Which one of the following have high CO_2 compensation point ?
(1) C_2 plants
(2) C_3 plants
(3) C_4 plants
(4) CAM plants

77. First stable product of Photorespiration is :-
(1) PGAL
(2) Glycerate
(3) Glycine
(4) Phosphoglycolate

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78. Photorespiration is favoured by :-
(1) Low light intensity
(2) Low O_2 & high CO_2
(3) Low temperature
(4) High O_2 & Low CO_2

79. What is C_2 - Cycle ?
(1) Glycolate cycle
(2) Calvin cycle
(3) Kreb's cycle
(4) TCA - cycle

80. Compensation point means :-
(1) When the rate of photosynthesis is equal to rate of respiration
(2) When there is neither photosynthesis nor respiration
(3) When the entire food manufactured in photosynthesis remains unutilized
(4) When availability of water equalise with necessity of water.

81. What does not occur in photorespiration
(1) Utilization of O_2
(2) Production of CO_2
(3) Synthesis of ATP
(4) Use of ATP

82. DCMU is an inhibitor of :-
(1) PS-I (2) PS-II
(3) Calvin cycle (4) Kreb's cycle

83. Main factor which limits the rate of photosynthesis on a clear day is :-
(1) Chlorophyll (2) Light
(3) CO_2 (4) Water

84. Which one of the following is wrong in relation to photorespiration ?
(1) It occurs in chloroplast
(2) It occurs in daytime only
(3) It is a characterisitic of C_4 plants
(4) It is a characteristic of C_3 plants

85. The law of limiting factor for photosynthesis was given by :–
(1) R. Hill
(2) Krebs
(3) Calvin
(4) Blackman

EXERCISE-I (Conceptual Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	3	2	3	1	1	4	2	2	4	2	3	1	1	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	1	3	3	3	3	1	2	3	2	2	3	1	2	1	1
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	4	1	3	4	4	1	2	3	1	2	1	2	3	2	2
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	4	2	2	2	4	4	2	4	1	2	1	2	3	2	1
Question	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Answer	4	1	4	3	1	1	2	2	2	1	3	3	1	3	4
Question	76	77	78	79	80	81	82	83	84	85					
Answer	2	4	4	1	1	3	2	3	3	4					

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Exercise - II (Previous Year Questions) AIPMT/NEET

AIPMT 2006

1. In photosystem-I, the first electron acceptor is
(1) Plastocyanin
(2) An iron-sulphur protein
(3) Ferredoxin
(4) Cytochrome

2. During photorespiration, the oxygen consuming reaction(s) occur in
(1) Grana of chloroplasts and peroxisomes
(2) Stroma of chloroplasts
(3) Stroma of chloroplasts and mitochondria
(4) Stroma of chloroplasts and peroxisomes

AIPMT 2007

3. The first acceptor of electrons from an excited chlorophyll molecule of photosystem II is: -
(1) Quinone
(2) Cytochrome
(3) Iron-sulphur protein
(4) Ferredoxin

4. In the leaves of C_4 plants, malic acid formation during CO_2 fixation occurs in the cells of: -
(1) Epidermis (2) Mesophyll
(3) Bundle Sheath (4) Phloem

AIPMT 2008

5. In leaves of C_4 plants malic acid synthesis during CO_2 fixation occurs in: -
(1) Bundle sheath (2) Guard cells
(3) Epidermal cells (4) Mesophyll cells

6. The C_4 plants are photosynthetically more efficient than C_3 plants because: -
(1) The CO_2 efflux is not prevented
(2) They have more chloroplasts
(3) The CO_2 compensation point is more
(4) CO_2 generated during photorespiration is trapped and recycled through PEP carboxylase

7. Electrons from excited chlorophyll molecule of photosystem II are accepted first by: -
(1) Quinone (2) Ferredoxin
(3) Cytochrome–b (4) Cytochrome –f

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AIPMT 2009

8. Oxygenic photosynthesis occurs in: -
(1) Oscillatoria (2) Rhodospirillum
(3) Chlorobium (4) Chromatium

9. Cyclic photophosphorylation results in the formation of: -
(1) ATP and NADPH
(2) ATP, NADPH and O_2
(3) ATP
(4) NADPH

AIPMT Pre-2010

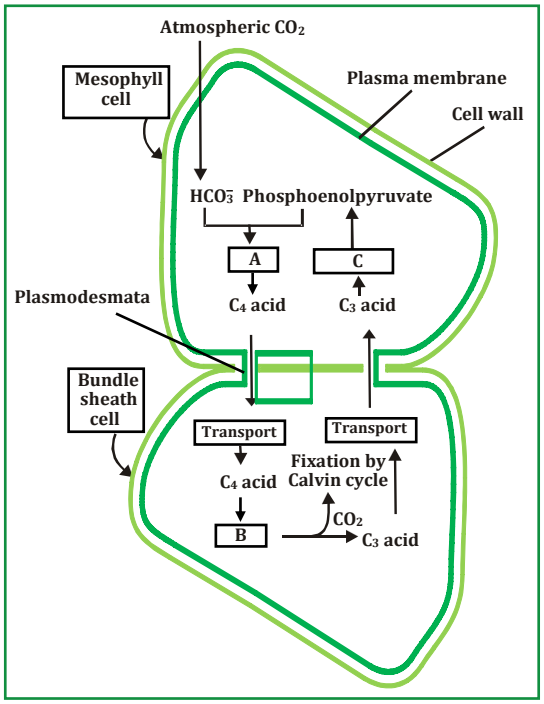
10. PGA as the first CO_2 fixation product was discovered in photosynthesis of :-
(1) Bryophyte (2) Gymnosperm
(3) Angiosperm (4) Alga

11. C_4 plants are more efficient in photosynthesis than C_3 plants due to :-
(1) Higher leaf area
(2) Presence of larger number of choloplasts in the leaf cells
(3) Presence of thin cuticle
(4) Lower rate of photorespiration

AIPMT Mains-2010

12. Read the following four statements, A, B, C and D and select the right option having both correct statements.
Statements:
(A) Z scheme of light reaction takes place in present of PSI only.
(B) Only PSI is functional in cyclic photophosphorylation
(C) Cyclic photophosphorylation results into synthesis of ATP and NADPH(H+)
(D) Stroma lamellae lack PSII as well as NADP reductase
Options:
(1) A and B (2) B and C
(3) C and D (4) B and D

13. Study the pathway given below: -



In which of the following options correct words for all the three blanks A, B and C are indicated?

	A	B	C
(1)	Fixation	Transamination	Regeneration
(2)	Fixation	Decarboxylation	Regeneration
(3)	Carboxylation	Decarboxylation	Reduction
(4)	Decarboxylation	Reduction	Regeneration

AIPMT Pre-2011

14. CAM helps the plants in: -
(1) Conserving water
(2) Secondary growth
(3) Disease resistance
(4) Reproduction

AIPMT Mains-2011

15. In Kranz anatomy, the bundle sheath cells have: -
(1) thick walls, many intercellular spaces and few chloroplasts
(2) thin walls, many intercellular spaces and no chloroplasts.
(3) thick walls, no intercellular spaces and large number of chloroplasts.
(4) thin walls, no intercellular spaces and several chloroplasts.

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AIPMT Pre-2012

16. A process that makes important difference between C_3 and C_4 plants is: -
(1) Photosynthesis
(2) Photorespiration
(3) Transpiration
(4) Glycolysis

17. The correct sequence of cell organelles during photorespiration is :-
(1) Chloroplast-mitochondria-peroxisome
(2) Chloroplast-vacuole-peroxisome
(3) Chloroplast-Golgibodies-mitochondria
(4) Chloroplast-Rough endoplasmic reticulum-Dictyosomes

AIPMT 2014

18. Anoxygenic photosynthesis is characteristic of-
(1) Rhodospirillum (2) Spirogyra
(3) Chlamydomonas (4) Ulva

Re-AIPMT 2015

19. Chromatophores take part in: -
(1) Respiration (2) Photosynthesis
(3) Growth (4) Movement

20. In photosynthesis, the light-independent reactions take place at: -
(1) Stromal matrix (2) Thylakoid lumen
(3) Photosystem-I (4) Photosystem-II

NEET-I 2016

21. Emerson's enhancement effect and red drop have been instrumental in the discovery of: -
(1) Photophosphorylation and non-cyclic electron transport
(2) Two photosystems operating simultaneously
(3) Photophosphorylation and cyclic electron transport
(4) Oxidative phosphorylation

22. In a chloroplast the highest number of protons are found in: -
(1) Stroma
(2) Lumen of thylakoids
(3) Inter membrane space
(4) Antennae complex

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23. A plant in your garden avoids photorespiratory losses, has improved water use efficiency shows high rates of photosynthesis at high temperatures and has improved efficiency of nitrogen utilisation. In which of the following physiological groups would you assign this plant?
(1) C_3 (2) C_4
(3) CAM (4) Nitrogen fixer

NEET-II 2016

24. The process which makes major difference between C_3 and C_4 plants is: -
(1) Photorespiration (2) Respiration
(3) Glycolysis (4) Calvin cycle

NEET-UG 2017

25. With reference to factors affecting the rate of photosynthesis, which of the following statements is not correct?
(1) Increasing atmospheric CO_2 concentration up to 0.05% can enhance CO_2 fixation rate
(2) C_3 plants respond to higher temperatures with enhanced photosynthesis while C_4 plants have much lower temperature optimum
(3) Tomato is a greenhouse crop which can be grown in CO_2 - enriched atmosphere for higher yield
(4) Light saturation for CO_2 fixation occurs at 10% of full sunlight

26. Phosphonyl pyruvate (PEP) is the primary CO_2 acceptor in:
(1) C_4 plants (2) C_2 plants
(3) C_3 and C_4 plants (4) C_3 plants

NEET-UG 2018

27. Oxygen is not produced during photosynthesis by: -
(1) Green Sulphur bacteria
(2) Nostoc
(3) Cycas
(4) Chara

28. Which of the following is not a product of light reaction of photosynthesis?
(1) ATP (2) NADH
(3) NADPH (4) Oxygen

NEET-UG 2019 (Odisha)

29. In Hatch and Slack pathway, the primary CO_2 acceptor is: -
(1) Oxaloacetic acid
(2) Phosphoglyceric acid
(3) Phosphoenol pyruvate
(4) RuBisCO

30. One scientist cultured Cladophora in a suspension of Azotobacter and illuminated the culture by splitting light through a prism. He observed that bacteria accumulated mainly in the region of:
(1) Violet and green light
(2) Indigo and green light
(3) Orange and yellow light
(4) Blue and red light

NEET-UG 2020

31. In light reaction, plastoquinone facilitates the transfer of electrons from :
(1) PS-I to ATP synthase
(2) PS-II to $Cytb_6$-f complex
(3) $Cytb_6$-f complex to PS-I
(4) PS-I to $NADP^+$

32. The oxygenation activity of RuBisCo enzyme in photorespiration leads to the formation of
(1) 1 molecule of 4-C compound and 1 molecule of 2-C compound.
(2) 2 molecules of 3-C compound
(3) 1 molecule of 3-C compound
(4) 1 molecule of 6-C compound

NEET-UG (COVID-19) 2020

33. During non-cyclic photophosphorylation, when electrons are lost from the reaction centre at PS II, what is the source which replaces these electrons?
(1) Oxygen (2) Water
(3) Carbon dioxide (4) Light

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34. Which of the following statements is incorrect?
(1) RuBisCO is a bifunctional enzyme
(2) In C_4 plants, the site of RuBisCO activity is mesophyll cell
(3) The substrate molecule for RuBisCO activity is a 5-carbon compound
(4) RuBisCO action requires ATP and NADPH

NEET-UG 2021

35. The first stable product of CO_2 fixation in sorghum is :
(1) Pyruvic acid
(2) Oxaloacetic acid
(3) Succinic acid
(4) Phosphoglyceric acid

36. Which of the following statements is incorrect?
(1) Both ATP and NADPH + H+ are synthesized during non-cyclic photophosphorylation.
(2) Stroma lamellae have PS I only and lack NADP reductase.
(3) Grana lamellae have both PS I and PS II.
(4) Cyclic photophosphorylation involves both PS I and PS II.

NEET-UG [Paper-2] 2021

37. In the plastid, the site of dark and light reaction is
(1) Grana and stroma respectively
(2) Grana and matrix respectively
(3) Matrix and grana respectively
(4) Stroma and grana respectively

38. The maximum absorption of light by chlorophyll occurs in which region of the absorption spectrum.
(1) Red and green (2) Yellow and green
(3) Blue and red (4) Brown and red

39. Non-cyclic photophosphorylation results in the formation of
(1) ATP and NADH + H^+
(2) ATP only
(3) ATP and NADPH + H^+
(4) ATP, ADP and NADH + H^+

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NEET-UG 2022

40. Given below are two statements :
Statement I: The primary CO_2 acceptor in C_4 plants is phosphoenolpyruvate and is found in the mesophyll cells.
Statement II: Mesophyll cells of C_4 plants lack RuBisCo enzyme.
In the light of the above statements, choose the correct answer from the options given below:
(1) Both Statement I and Statement II are incorrect
(2) Statement I is correct but Statement II is incorrect
(3) Statement I is incorrect but Statement II is correct
(4) Both Statement I and Statement II are correct

41. Which one of the following is not true regarding the release of energy during ATP synthesis through chemiosmosis? It involves :
(1) Breakdown of electron gradient
(2) Movement of protons across the membrane to the stroma
(3) Reduction of NADP to NADPH2 on the stroma side of the membrane
(4) Breakdown of proton gradient

42. What is the role of large bundle shealth cells found around the vascular bundles in C_4 plants?
(1) To increase the number of chloroplasts for the operation of Calvin cycle
(2) To enable the plant to tolerate high temperature
(3) To protect the vascular tissue from high light intensity
(4) To provide the site for photorespiratory pathway

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43. When one CO_2 molecule is fixed as one molecule of triose phosphate, which of the following photochemically made, high energy chemical intermediates are used in the reduction phase ?

(1) 1 ATP + 1 NADPH
(2) 1 ATP + 2 NADPH
(3) 2 ATP + 1 NADPH
(4) 2 ATP + 2 NADPH

44. Match List - I with List - II :

List - I	List - II
(a) Porins	(i) Pink coloured nodules
(b) leg haemoglobin	(ii) Lumen of thylakoid
(c) H+ accumulation	(iii) Amphibolic pathway
(d) Respiration	(iv) Huge pores in outer membrane of mitochondria

Choose the correct answer from the options given below :

(1) (a)–(ii), (b)–(i), (c)–(iv), (d)–(iii)
(2) (a)–(iv), (b)–(i), (c)–(ii), (d)–(iii)
(3) (a)–(iii), (b)–(iv), (c)–(ii), (d)–(i)
(4) (a)–(ii), (b)–(iv), (c)–(i), (d)–(iii)

45. Identify the correct statements regarding chemiosmotic hypothesis :

(a) Splitting of the water molecule takes place on the inner side of the membrane.
(b) Protons accumulate within the lumen of the thylakoids.
(c) Primary acceptor of electron transfers the electrons to an electron carrier.
(d) NADP reductase enzyme is located on the stroma side of the membrane.
(e) Protons increase in number in stroma.

Choose the correct answer from the options given below:

(1) (a), (b) and (e)
(2) (a), (b) and (d)
(3) (b), (c) and (d)
(4) (b), (c) and (e)

EXERCISE-II (Previous Year Questions) ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	2	4	1	2	4	2	1	1	3	4	2	4	2	1	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	1	1	2	1	2	2	2	1	2	1	1	2	3	4
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	2	3	2	2	2	4	4	3	3	4	1	1	1	2	2

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Exercise - III Master Your Understanding

EXERCISE-III(A) NCERT BASED QUESTIONS

1. "Only green part of the plants could release oxygen" this is shown by –
(1) Priestley (2) Moll
(3) Ingenhousz (4) Julius Van Sachs

2. In Calvin cycle which step involve utilisation of 2 molecules of ATP for phosphorylation and two of $NADPH_2$ per CO_2 molecule fixed?
(1) Regeneration (2) Carboxylation
(3) Reduction (4) All of above

3. Which character make C_4 plants special ?
(1) Special type of leaf anatomy
(2) They can tolerate high temperature
(3) Show response to high light intensities
(4) All of the above

4. Most abundant enzyme in the world is –
(1) Collagen
(2) RubisCO
(3) PEPcase
(4) Pyruvate dikinase

5. For every CO_2 molecule entering the Calvin cycle, required energy is :-
(1) 3 ATP and 2 NADPH
(2) 2 ATP and 3 NADPH
(3) 3 ATP and 3 NADPH
(4) 2 ATP and 2 NADPH

6. In C_4 plants, bundle sheath cells are characterised by :-
(1) Large number of chloroplasts
(2) Thick walls impervious to gaseous exchange
(3) No intercellular spaces
(4) All the above

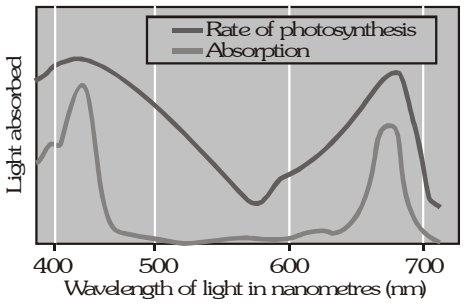
7. In C_4 plants photorespiration does not occur, due to:-
(1) Presence of RubisCO enzyme
(2) Presence of high light intensity
(3) Increased concentration of CO_2 at RuBisCO enzyme site
(4) Presence of bundle sheath cells.

8. In photosynthesis during ATP formation accumulation of protons occurs :-
(1) in lumen of thylakoid
(2) in stroma of chloroplast
(3) in periplastidial space
(4) at outer surface of thylakoid

9. By using the bell jar, which of the following showed that sunlight is essential to plant process that purifies the air?
(1) Joseph priestley (2) Julius Von Sachs
(3) T.W. Engelmann (4) Jan Ingenhousz

10. Radioisotopic technique was used to prove some facts about :-
(1) light reaction of photosynthesis
(2) biosynthetic phase of photosynthesis
(3) Both (1) and (2)
(4) Different shapes of chloroplasts in plants

11. Represented below is the graph showing action spectrum of photosynthesis superimposed on absorption spectrum of chlorophyll 'a'. Which one of the following is **correct** for this ?



(1) There is a complete one to one overlap between the absorption and action spectrum
(2) By this overlapping it can be concluded that chlorophyll 'a'is the chief pigment of photosynthesis
(3) This overlapping shows that only chlorophyll 'a' absorb the entire light energy
(4) These graphs show that photosynthesis occurs only in the wavelengths of blue and red light

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12. The plants with Hatch and Slack pathway are adapted to :-
(1) humid temperate regions
(2) dry temperate regions
(3) humid tropical regions
(4) dry tropical regions

13. Which of the following is correct?
(1) The C_3 and C_4 plants respond similarly to CO_2 conentrations
(2) At low light conditions C_4 plats show increase in the rates of photosynthesis
(3) C_4 plants not respond to high temperature
(4) The C_3 and C_4 plants respond differently to CO_2 concentrations

14. Word dark reaction for biosynthetic phase of photosynthesis is misnomer word because :-
(1) Dark reaction occur during dark
(2) Dark reaction occur during day
(3) Dark reaction is completely free from light
(4) Dark reaction occur during short dark intervals

15. Photosynthetic photosystem is consist of :-
(1) Reaction centre only
(2) LHC only
(3) Both LHC & reaction centre
(4) Proteins only

16. In grana lamellae, presence of which of the following specify that 'z' scheme found only in grana lamellae?
(1) PS-I, PS-II
(2) PS-II & NADP reductase
(3) PS-I & NADP reductase
(4) Mg^{++}

17. An elegant experiment with an aquatic plant showed that in bright sunlight, small bubbles were formed around the green parts while in the dark they did not. It was done by :-
(1) Jan Ingenhousz (2) Van Sachs
(3) Priestley (4) Van Niel

18. How many ATP are required for regeneration of RUBP in one Calvin cycle?
(1) 6 ATP (2) 1 ATP
(3) 3 ATP (4) 12 ATP

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19. Based on his studies of purple & green bacteria who demonstrated that photosynthesis is essentially a light dependent reaction in which hydrogen from a suitable oxidisable compound reduces CO_2 to carbohydrates?
(1) Van Niel (2) Von Sachs
(3) Calvin (4) Priestley

20. Which of following is correct about dark reaction?
(1) It is not directly light driven but are dependent on products of light reaction (ATP & NADPH)
(2) It occurs in stroma of chloroplast by enzymatic reactions
(3) Both (1) & (2)
(4) It occurs in stroma lamellae

21. Which of the following is most crucial step of Calvin cycle?
(1) Carboxylation
(2) Reduction
(3) Regeneration
(4) Glycolytic reversal

22. Find out the **correct match** from the following table :-

	Column-I	Column-II	Column-III
(i)	Photochemical phase	Photosystem - II	Oxygen release
(ii)	Paper Chromatography	Chlorophyll 'b'	Yellow orange
(iii)	Carotenoids	Chief pigment	Red light absorption

(1) (i) only (2) (i) and (ii)
(3) (iii) only (4) (ii) and (iii)

23. During photosynthesis, plants mainly utilise the red and blue regions of visible spectrum, for the first time it was concluded by :
(1) Jan Ingenhousz
(2) Joseph Priestley
(3) T.W. Engelmann
(4) Cornelius Van Niel

24. Which of the following conclusions regarding photosynthesis was proved by using radioisotopic techniques ?
(1) Light is essential
(2) O_2 comes from H_2O and not from CO_2
(3) Glucose is stored as starch
(4) Exchange of gases with environment

25. The dark reactions of the photosynthesis :
(1) occur in darkness
(2) are not light dependent
(3) are not directly light driven
(4) occur in membrane system of chloroplast

26. Electrons from which of following reduces $NADP^+$ to NADPH + H^+ during Z-scheme of photosynthesis?
(1) Photosystem-I (2) Water
(3) Carbon dioxide (4) Photosystem-II

27. During photosynthesis the stroma lamellae of chloroplast could perform :
(1) the process of dark reaction in which ATP utilised
(2) the process of light reaction which produce NADPH + H^+
(3) the process of dark reaction which utilise NADPH + H^+
(4) the process of light reaction which produce ATP

28. Which of the following statements are correct regarding synthesis of ATP in chloroplast during photosynthesis ?
(A) Splitting of water in stroma helps in creation of proton gradient
(B) Cytochrome complex helps in the release of protons in the lumen of thylakoid by accepting electrons from hydrogen carrier.
(C) Movement of protons across the membrane to the stroma through the F_0 of the ATPase is coupled with ATP synthesis.
(D) Reduction of $NADP^+$ to NADPH + H^+ is also a cause for creation of proton gradient.
(1) All statements are correct
(2) C and D
(3) A and B
(4) B, C and D

29. What is the correct ratio of ATP utilisation in steps of Calvin cycle?
(1) Reduction : Regeneration :: 1 : 1
(2) Reduction : Regeneration :: 2 : 1
(3) Reduction : Regeneration :: 2 : 2
(4) Reduction : Regeneration :: 1 : 2

30. The cells of C_4 plants those are rich in RuBisCO enzyme, also have which of the following characteristic (s)?
(1) Intercellular spaces absent
(2) Thick walls impervious to gaseous exchange
(3) Large number of chloroplast
(4) All of the above

31. The productivity is better in C_4 plants because:
(1) they increase the intracellular concentration of CO_2 in mesophyll cells
(2) in these plants RuBisCO has much greater affinity for O_2 than for CO_2
(3) these plants can prevent competitive binding phenomena related to RuBisCO
(4) these plants minimise the carboxylase activity of RuBisCO

32. C_3 plants respond to higher CO_2 concentration by showing increased rates of photosynthesis because:
(1) Current availability of CO_2 levels is limiting to the C_3 plants
(2) C_3 plants show saturation at about 360 $\mu\ell L^{-1}$ concentration of CO_2
(3) these plants responds to high CO_2 concentration even in low light conditions
(4) in these plants RuBisCO shows only carboxylation

33. $2H_2A + CO_2 \longrightarrow 2A + CH_2O + H_2$
in this given equation H_2A represents to :
(1) Suitable reducible compounds
(2) Suitable oxidisable compound
(3) Suitable buffer
(4) Both (1) and (2)

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34. The membrane system of chloroplast is responsible for :
(1) Trapping the light energy
(2) Synthesis of ATP & NADPH
(3) Enzymatic reactions for CO_2 incorporation
(4) Both (1) and (2)

35. How does PS-II supply electrons continuously?
(1) by removing electrons from photon
(2) by removing electrons from H_2O
(3) by removing electrons from CO_2
(4) by removing electrons from constituent carotenoids

36. Which of the following is not always required for chemiosmosis ?
(1) Membrane (2) Proton pump
(3) OEC (4) ATP synthase

37. Classification of biosynthetic phase of dark reaction as C_3 & C_4 is primarily based on.
(1) Initial CO_2 fixation
(2) Final CO_2 assimilation
(3) First CO_2 receptor
(4) Number of ATP get consumed

38. Which of the following is not special about C_4 plants?
(1) Responsiveness to high light intensities
(2) Lack of photorespiration
(3) Greater productivity
(4) Scotoactive stomata

39. Which of the following is not a plant factor regulating photosynthesis ?
(1) Age of leaf
(2) Number of mesophyll cells
(3) Atmospheric CO_2 concentration
(4) Amount of chlorophyll

40. CO_2 is the major limiting factor for photosynthesis because the concentration of CO_2 is very low in the atmosphere which is :-
(1) between 0.01 and 0.02 per cent
(2) between 0.02 and 0.03 per cent
(3) between 0.03 and 0.04 per cent
(4) between 0.06 and 0.07 per cent

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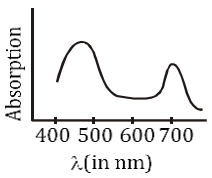
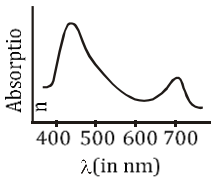
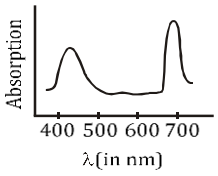
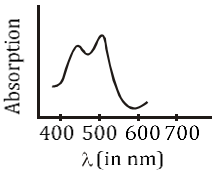
41. (a) Formation of ATP and NADPH
(b) Use of ATP
(c) Reduction of PGA
(d) Water splitting
(e) Oxygen release
Which of the above processes are included in the dark reaction of photosynthesis ?
(1) a, b and c (2) c and e
(3) b and c (4) b, c and e

42. Which of the following statements is correct in relation to the photosynthesis ?
(1) It is the redox reaction during which reduction of H_2O and oxidation of CO_2 occurs
(2) First of all it started in *Chlorella*
(3) It converts light energy into chemical energy in night
(4) Photosynthesis results in synthesis of sugar

43. (A) 

(B) 

(C) 

(D) 

Regarding to given curves select the incorrect identification :-
(1) A is the absorption spectrum of chl 'a'
(2) B is the absorption spectrum of the chl 'b'
(3) C is the absorption spectrum of chl 'b'
(4) D is the absorption spectrum of carotenoids.

44. Which of the following step(s) of Calvin cycle require(s) both ATP and NADPH(H^+) ?
(1) Carboxylation and regeneration
(2) Carboxylation
(3) Reduction
(4) Regeneration

45. During photosynthesis, fixation of one CO_2 molecule in maize (A) and tomato (B) plant require :-
(1) [A] - 5 ATP & 2 NADPH + $2H^+$
[B] - 3 ATP & 2 NADPH + $2H^+$
(2) [A] - 3 ATP & 2 NADPH + $2H^+$
[B] - 3 ATP & 2 NADPH + $2H^+$
(3) [A] - 2 ATP & 2 NADPH + $2H^+$
[B] - 3 ATP & 2 NADPH + $2H^+$
(4) [A] - 30 ATP & 12 NADPH + $12H^+$
[B] - 18 ATP & 12 NADPH + $12H^+$

46. How many carbons are present in first CO_2 acceptor in *sorghum* ?
(1) 5 (2) 4
(3) 3 (4) 2

47. How many electrons are required to produce sufficient reducing power [NADPH + H^+] to fix 6 CO_2 molecules to form glucose?
(1) 6 electrons (2) 12 electrons
(3) 18 electrons (4) 24 electrons

48. Which of the following is correct for photosynthesis?
(1) use light energy to drive the synthesis of organic compounds
(2) primary source of all food on earth
(3) responsible for release of oxygen into the atmosphere
(4) All of the above

49. Studies by which of the following scientists showed that the green substance in plants is located in special bodies within plant cells?
(1) T.W. Engelmann
(2) Julius Von Sachs
(3) Cornelius Van Niel
(4) Joseph Priestley

50. Action spectrum of photosynthesis roughly resembles the :-
(1) absorption spectrum of chlorophyll a
(2) absorption spectrum of chlorophyll b
(3) both (1) and (2)
(4) absorption spectrum of carotenoids

51. Which of the following is correct for the carbon reactions of photosynthesis ?
(1) They occur in the membranous system of chloroplast
(2) They are not light dependent
(3) They synthesize sugar, ATP and NADPH
(4) They are not directly light driven

52. $2H_2O \longrightarrow 4H^+ + O_2 + 4e^-$
Above reaction is a part of :-
(1) biosynthetic phase of photosynthesis in C_3 plants
(2) Z-Scheme of light reaction of photosynthesis
(3) Hatch and slack pathway
(4) Cyclic photophosphorylation

53. Respectively during the creaction of proton gradient and breakdown of proton gradient in chloroplast, protons move :-
(1) from the stroma to cytoplasm and from the cytoplasm to stroma
(2) from the cytoplasm to stroma and from stroma to cytoplasm
(3) from the thylakoid lumen to stroma and from the stroma to thylakoid lumen
(4) from the stroma to thylakoid lumen and from the thylakoid lumen to stroma

54. In photosynthesis (Choose the correct one):-
(1) Phosphorylation can occur in light reaction only
(2) Phosphorylation can occur in biosynthetic phase only
(3) Phosphorylation can occur in both light reaction and biosynthetic phase
(4) Phosphorylation not occurs at all

55. Which of the following is a probable reason that why cyclic photophosphorylation takes place in photosynthesis?
(1) To supply extra carbondioxide to Calvin cycle
(2) To ulilise the light of wavelength of 680 nm which is not utilised in noncyclic photophosphorylation
(3) To produce extra NADPH for biosynthetic phase
(4) To meet the difference in number of ATP and NADPH

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56. C_4 plants are special plants having Kranz anatomy in their leaves, here term 'Kranz' is a reflection of :-
(1) large number of chloroplasts in mesophyll cells
(2) capacity to tolerate high temperatures
(3) absence of chloroplasts in bundle sheath cells
(4) ring like arrangement of cells

57. During the dark reaction of photosynthesis in C_4 plants (Choose the correct one) :-
(1) regeneration step occurs in mesophyll cell only
(2) regeneration step occurs in bundle sheath cell only
(3) regeneration steps occur in both mesophyll cell and bundle sheath cell
(4) there is no step of regeneration

58. RuBP+...A... $\xrightarrow{\text{RuBisCO}}$ 2 × Phosphoglycerate
RuBP+...B... $\xrightarrow{\text{RuBisCO}}$ Phosphoglycerate + Phosphoglycolate
Choose correct match for A and B from given options :-
(1) A = NADPH, B = CO_2
(2) A = O_2, B = CO_2
(3) A = CO_2, B = O_2
(4) A = CO_2, B = NADPH

59. Before the discovery of RuBP as primary acceptor of CO_2 in Calvin cycle, it was believed that the primary acceptor would be :-
(1) a 6-carbon compound
(2) a 2-carbon compound
(3) a 3-carbon compound
(4) a 4-carbon compound

EXERCISE-III(B) ANALYTICAL QUESTIONS

60. Glycolate accumulates in chloroplast at :-
(1) Low temp.
(2) Low CO_2
(3) Visible light illumination
(4) High CO_2

61. For the synthesis of one molecule of sucrose, how may ATP molecules are required in reduction step of Calvin cycle?
(1) 24 ATP (2) 18 ATP
(3) 2 ATP (4) 12 ATP

62. Which of the following is the product of oxidation during photosynthesis ?
(1) Carbondioxide (2) Glucose
(3) Water (4) Oxygen

63. In Calvin cycle, CO_2 is fused with primary acceptor molecule to form 3C compound phosphoglycerate. If in this reaction CO_2 provides one carbon then how many carbons are present in primary acceptor molecule ?
(1) Five carbons (2) Two carbons
(3) Six carbons (4) Three carbons

64. In photosynthesis, NADPH + H^+ are oxidised in :-
(1) Calvin cycle
(2) noncyclic photophosphorylation
(3) cyclic photophosphorylation
(4) Z-scheme

65. Enzyme, which can catalyse both carboxylation and oxygenation of RuBP in the chloroplast, is **not** found in which of the following cells ?
(1) Mesophyll cells of C_4 plants
(2) Mesophyll cells of C_3 plants
(3) Mesophyll cells of CAM plants
(4) Bundle sheath cells of C_4 plants

66. The product of light reaction of photosynthesis, which is not common between cyclic and non-cyclic photophosphorylation and is not utilized in Calvin cycle, is :-
(1) O_2 (2) ATP
(3) $NADPH_2$ (4) O_2 and ATP

67. Which phase of Calvin cycle does/do not use any energy rich molecule ?
(1) Carboxylation only
(2) Carboxylation and reduction
(3) Reduction and regeneration
(4) Reduction only

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68. The C_4 plants differ from C_3 plants with reference to the :-
(1) Primary acceptor of CO_2 in dark reaction
(2) Type of end product of photosynthesis
(3) Number of $NADPH_2$ that are consumed in synthesis of hexose
(4) Type of pigments involved in photosynthesis.

69. The common feature between non-cyclic and cyclic photophosphorylation is :-
(1) Proton gradient formation
(2) Release of O_2
(3) Formation of $NADPH + H^+$
(4) Photolysis of water

70. The second acceptor of CO_2 in C_4 plants is :-
(1) PEP (2) Malate
(3) Aspartate (4) RuBP

Exercise - III ANSWER KEY

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Answer	3	3	4	2	1	4	3	1	4	3	2	4	4	2	3
Question	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Answer	2	1	2	1	3	1	1	3	2	3	1	4	4	2	4
Question	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Answer	3	1	2	4	2	3	1	4	3	3	3	4	3	3	1
Question	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Answer	3	4	4	2	3	4	2	4	3	4	4	3	3	2	2
Question	61	62	63	64	65	66	67	68	69	70					
Answer	1	4	1	1	1	1	1	1	1	4					